

1 CLAIMS

2 What is claimed is:

- 3 1. An image processing method comprising the steps of:
4 dividing an inputted image into pixel groups, each of
5 which has a specified size;
6 calculating a pixel group density for each of the
7 divided pixel groups; and
8 calculating an output value of a certain watched pixel
9 based on an absolute density of the watched pixel and a
10 relative density for the watched pixel, the relative density
11 being calculated based on the pixel group density of the
12 pixel group, to which the watched pixel belongs, and the
13 pixel group density of the pixel group adjacent to the pixel
14 group, to which the watched pixel belongs, among the pixel
15 groups in the image.
- 16 2. The image processing method according to claim 1,
17 wherein the step of dividing an inputted image into the
18 pixel groups is meshing the image into sub images, each of
19 which has a rectangular area.
- 20 3. The image processing method according to claim 1,
21 wherein the relative density is calculated by use of an
22 influence degree calculated based on a distance from the
23 watched pixel and the pixel group, to which the watched
24 pixel belongs, to the pixel group adjacent to the pixel
25 group, each of the adjacent pixel group being located on and
26 under and at the right and left of the pixel group.

4. The image processing method according to claim 3,
wherein in the step of calculating the pixel group den-
sities, an average density of the divided pixel group is
calculated, and

the relative density is obtained by multiplying the
respective average densities of the pixel group, to which
the watched pixel belongs, and of the pixel group adjacent
to the pixel group, to which the watched pixel belongs, by
the respective influence degrees.

5. The image processing method according to claim 1,
wherein the relative density is calculated based on an
influence degree obtained by a trapezoidal function repre-
senting a positional relation between a coordinate position
of the watched pixel and the pixel group adjacent to the
pixel group, to which the watched pixel belongs.

6. The image processing method according to claim 1,
wherein in the step of calculating an output value, the
relative and absolute densities are weighted to calculate
the output value.

7. A relative density detecting method for detecting a rela-
tive density of a watched pixel constituting an inputted
image, comprising the steps of:

dividing the image into pixel groups, each of which has
a specified size;

detecting a pixel group density for each of the divided
pixel groups;

extracting positional information for the watched pixel
in a pixel group including the watched pixel; and

1 detecting a relative density of the watched pixel based
2 on the pixel group density and the positional information.

3 8. An image processing apparatus comprising:

4 pixel group dividing means for dividing an inputted
5 image into pixel groups, each of which has a specified size;

6 pixel group density detecting means for detecting a
7 pixel group density for each of the pixel groups divided by
8 the pixel group dividing means;

9 weight deciding means for deciding each weight of the
10 pixel groups adjacent to the pixel, to which a watched pixel
11 belongs, based on a position of the watched pixel to be
12 outputted;

13 watched pixel density detecting means for detecting a
14 density of the watched pixel; and

15 relative density calculating means for calculating a
16 relative density of the watched pixel based on a detected
17 density of the watched pixel, a pixel group density of the
18 detected pixel group and a decided weight of the pixel
19 group.

20 9. The image processing apparatus according to claim 8, fur-
21 ther comprising:

22 output density calculation means for calculating an
23 output density by weighting the density of the watched pixel
24 detected by the watched pixel density detecting means and
25 the relative density calculated by the relative density cal-
26 culating means.

27 10. The image processing apparatus according to claim 8,

1 wherein the pixel group dividing means roundly divides
2 an inputted image into meshes, each of which has I pixels×J
3 pixels (I, J: integers).

4 11. The image processing apparatus according to claim 8,
5 wherein the weight deciding means comprises a table
6 look-up for deciding weights of pixel groups adjacent to a
7 pixel group, to which the watched pixel belongs, based on a
8 coordinate position of the watched pixel, the pixel groups
9 being located at the right and left of the pixel group, to
10 which the watched pixel belongs, and/or on and under the
11 pixel group, to which the watched pixel belongs.

12 12. The image processing apparatus according to claim 8,
13 wherein the weight deciding means adds weights of pixel
14 groups adjacent to a pixel group, to which the watched pixel
15 belongs, to obtain a sum of 1, the pixel groups being
16 located at the right and left of the pixel group, to which
17 the watched pixel belongs, and/or adds weights of pixel
18 groups adjacent to a pixel group, to which the watched pixel
19 belongs, to obtain a sum of 1, the pixel groups being
20 located on and under the pixel group, to which the watched
21 pixel belongs.

22 13. An image processing apparatus for converting image data,
23 which includes a specified object photographed by a digital
24 camera, into a binarized image, comprising:
25 a meshing unit for meshing the entire image data into
26 sub images;

1 an average density detection unit for detecting an
2 average density of each of the sub images meshed by the
3 meshing unit; and

4 a density detection unit for detecting a density of a
5 pixel constituting the object,

6 wherein a binarized image, in which an outline of the
7 object is emphasized, is generated based on a detected den-
8 sity of the pixel, an average density of the sub image, to
9 which the pixel belongs, and an average density of the sub
10 image adjacent to the certain sub image.

11 14. An article of manufacture comprising a computer usable
12 medium having computer readable program code means embodied
13 therein for causing image processing, the computer readable
14 program code means in said article of manufacture comprising
15 computer readable program code means for causing a computer
16 to effect the steps of claim 1.

17 15. An article of manufacture comprising a computer usable
18 medium having computer readable program code means embodied
19 therein for causing relative density detection, the computer
20 readable program code means in said article of manufacture
21 comprising computer readable program code means for causing a
22 computer to effect the steps of claim 7.

23 16. A program storage device readable by machine, tangibly
24 embodying a program of instructions executable by the machine
25 to perform method steps for causing image processing, said
26 method steps comprising the steps of claim 1.

1 17. A program storage device readable by machine, tangibly
2 embodying a program of instructions executable by the machine
3 to perform method steps for causing relative density detec-
4 tion, said method steps comprising the steps of claim 7.

5 18. A computer program product comprising a computer usable
6 medium having computer readable program code means embodied
7 therein for causing image processing, the computer readable
8 program code means in said computer program product compris-
9 ing computer readable program code means for causing a
10 computer to effect the apparatus of claim 8.